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USSR REPORT

Electronics and Electrical Engineering

No. 80

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THE OPERATION OF KEYED LOW-FREQUENCY AMPLIFIERS DRIVING A CHANGING LOAD

GALAKHOV, V. A.

[Abstract] The impact of load changes on the frequency characteristics of switched low-frequency amplifiers can be significantly reduced through the use of adaptive pulse-width modulation [APWM]. An APWM amplifier takes the form of a tracking system which provides for a certain degree of proportionality between the instantaneous values of the output signal and the signal being amplified at any point in time. While the characteristics of APWM amplifiers can usually only be computed with the use of numerical methods, this paper proposes a mathematical modeling technique convenient and applicable to such amplifiers. A block diagram of an APWM amplifier is shown and the relative gain and phase of the fundamental of the output signal are plotted as a function of the normalized frequency using the proposed algorithm. The calculated results are in good agreement with experiments performed using a breadboarded APWM amplifier with a power of 30 watts and a supply voltage of 30 volts designed around KT907A transistors. The cutoff frequency of its low pass filter was 10 KHz, while the maximum switching frequency was 45 KHz. Figures 2; references: 3 Russian. [122-8225]

ANTENNAS

THE CALCULATION OF THE INPUT IMPEDANCES OF LOSSY RADIATORS

KNYAZEV, A. S.

[Abstract] The method of induced e.m.f.'s, while an approximation technique, is nonetheless sufficiently precise for engineering practice in the calculation of the input impedances of lossy dipoles. An induced e.m.f. approach based on a reciprocity theorem is used to analyze the following: 1) A linear dipole in an infinite medium with arbitrary parameters; and 2) A linear dipole at the separation boundary between two media. A common underlying principle is the equating of the wave propagation constants of the field and the current along the dipoles, something which follows from Sommerfeld's notion of the unity of the propagation constant in directing systems, for example, cylindrical rods. Analytical expressions are derived through a detailed treatment of the two cases. A sample calculation is given for the resistive component of the input impedance of a asymmetrical dipole 10 m long and 0.2 m thick, placed in homogeneous ground with a specified conductivity and permittivity; the results for the derived formulas are plotted showing the input impedance resistive component as a function of the frequency from 0.5 to 5 MHz. Good agreement is noted with experimental data from the literature. Another sample calculation is given for the resistive input impedance component of a symmetrical dipole 20 m long and 6 mm thick placed at the surface of the earth. The relevant electrical parameters of the soil are specified and the resistive component of the impedance is plotted as a function of frequency from 1 to 10 MHz. Good general agreement is noted with experimental data, though the latter exhibits an oscillating change in the input resistance as a function of frequency because the dipole wire was not in close contact with the ground. Figures 4; references 22: 12 Russian, 10 Western.
[122-8225]

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TUNING HELICAL ANTENNAS FOR THE POLARIZATION AND PHASE CHARACTERISTICS

CHUZHKOV, Yu. P. and STEL'MASHENKO, V. Ye.

[Abstract] When various helical antennas, for example, cylindrical spirals with a small number of turns, conical configurations with spirals of equal pitch having a large vertex angle, etc., are used in a standing wave mode as the elements of antenna arrays, the electrical parameters of the system can deviate considerably from the design figures if a high degree of identicalness is not maintained in their fabrication. Because this situation is exacerbated when an antenna is designed to operate across a range of frequencies, and because the change in frequency causes a change in the distribution of the amplitudes and phases in the aperture of the array, it is essential to check all of the array elements prior to assembly in order to see that they have identical polarization characteristics. Techniques for tuning such array elements are discussed: Eliminate the current wave reflected from the end of a spiral by inserting an ohmic resistance in the last turn of the spiral at 1/4 wavelength from the end. Further, improving the coefficient of ellipticity (ratio of the minor to major axis of the polarization ellipse) by gradually shorting out a quarter wave segment of the conductor of the spiral at its end until its length is equal to 1/4 wavelength at the center of the working frequency band. This latter approach was used to obtain an ellipticity coefficient of no worse than 0.75 in a frequency ratio range of 2:1; conical equally spaced spirals with a vertex angle of 45° were used in this case. The point of resistance insertion was 0.232 wavelengths from the end and the resistor was 100 to 240 ohms, where the smaller values were for decimeter band antennas and the larger values for meter wavelengths. An ellipticity coefficient of nearly unity can be achieved when tuning to a fixed frequency. A drawback to the method is that it is inapplicable to high-power transmitting antennas. Another method involves simultaneously shorting a section of a spiral turn and rotating the antenna through a specified angle. The methods were used to construct a 12 element array of helical antennas, and in a frequency ratio range of 2:1, a phase scatter of no more than $\pm 3^{\circ}$ was achieved for all of the array elements. Figures 2; references 4: 3 Russian, 1 Western in translation.
[122-8225]

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION
TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

MICROCOMPUTERS IN THE LONG-LINE SERVICE

BERLIN, L. B., senior engineer, TTsUMS-23 [Territorial Center No 23 for Control
of Intercity Communications and Television], BERSON, V. M., engineer, TTsUMS-3,
VZYATY-SHEV, R. Ye., senior engineer, TTsUMS-3, LOKSHIN, Ye. A., service chief
of TTsUMS-3, MENG, V. A., chief engineer of TTsUMS-3, and SIGALOV, V. Z.,
deputy chief of TTsUMS-23

[Abstract] The authors discuss the use of microcomputers in Territorial Centers
No 3 and 23 for Control of Intercity Communications and Television as a basis
for automated systems that monitor the state of transmission channels. The
computer records messages on a page printer and transmits data to monitoring
points via voice-frequency telegraphy. Automated systems are described for
monitoring both group and line channels. Data can also be displayed on a moni-
tor screen. In this case, each change in state of the system is displayed in
two lines, and up to four events can be displayed simultaneously. In case more
information is needed, events can be displayed consecutively and recalled. The
introduction of these computerized monitoring systems is the first phase in
automating the operational processes in the long-line service. In the next
phase, provisions will be made for on-the-spot alteration of the network based
on monitoring information. Figures 5.
[140-6610]

PRODUCT QUALITY CONTROL SYSTEM

YAMALUTDINOV, I. T. and KAPLAN, Yu. I., engineers

[Abstract] The "Leningrad Metal Plant" Industrial Turbine Construction Associa-
tion is the leading enterprise producing highly economical steam, gas and hy-
draulic turbines. A complex system of product quality control was developed
as a subsystem of the sector control system: its goal is to create the most

favorable conditions for achieving and maintaining optimum product quality and production efficiency. It includes several subsystems: organization of quality control, planning of product quality; monitoring product quality, evaluation of quality and certification of products, labor quality control, etc. The State Seal of Quality was awarded among others to turbines of the Sayano-Shuchenskiy GES (hydroelectric power station), Site-1 GES (Canada), and the Sobradinho GES (Brazil). The new quality control system contains three groups of features common to all subdivisions instead of nine: labor discipline and organization, quality of labor results, and effectiveness and economic indicators of production. Such groups make it possible to evaluate subdivisions as a whole in terms of all indicators and each group separately. The new standard includes two incentive indicators which can increase the comprehensive quality coefficient. [76-8617]

COUPLING THE YES7077 AND SID-1000 DEVICES

YURCHENKO, A. A., senior engineer, Donetsk Road Computer Center

[Abstract] The YeS 7077 device is used as a terminal for the YeS 1022 computer. It consists of a control unit and Konsul keyboard. Much down time of the YeS 1022 is ascribed to keyboard malfunctions. The SID-1000 data display was used to replace the Konsul keyboard because it was proven to be more reliable. The SID-1000 utilizes different signal values for the upper and lower case characters, which requires a simple recoding algorithm to be introduced into the program. The DZM-180 dot matrix printer was chosen as the output device. The lack of audible response of the touch-sensitive keyboard, however, required the addition of a sound generator in order to ensure operator keying confidence. Figures 1.
[79-8617]

UDC 681.3-192:656.2

INCREASING THE OPERATING RELIABILITY OF MAGNETIC DRUM MEMORIES

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 9, Sep 80 pp 28-30

ERISTAVI, G. A. and BUGROVA, S. G., engineers, Gor'kiy Road Computer Center

[Abstract] Peripheral magnetic drum memories include the U-417 control drive
and NB-11(A) storage, and interface with the "Ural 14" computer's main memory.
Figures illustrate the circuit which prevents duplicate verification of the
last word of a file. Errors of the first kind are recorded when all informa-
tion in one or more lines suddenly disappears due to erroneous cycling of a
WRITE ENABLE signal. A high-frequency signal filter was designed in order to
eliminate this problem. Hydrolyzed alcohol, distilled right at the computer
center, is used to clean the heads every other month. Drum bearings are lubri-
cated every 10,000 hours. Figures 6.
[79-8617]

UDC 658.386.621.39

TRAINING OF SPECIALISTS IN THE FIELD OF DESIGNING DIGITAL COMMUNICATIONS
EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 80 pp 58-60

MALOLEPSHIY, G. A., GONCHAROV, Yu. A. and ZHELNOV. V. N.

[Abstract] The opinion of developers of microelectronic communications equip-
ment is given regarding educational requirements for specialists in the field
of designing digital communications equipment. Today engineers just out of
school are not sufficiently knowledgeable with regard to the circuitry and
systems engineering of large-scale and ultralarge-scale integrated circuits,
the theory of digitization, digital filtering and digital switching. The
mathematical emphasis of their training is also not oriented toward working
in these areas. They also have insufficient knowledge of the computer design
of digital communications equipment. They also are weak with regard to the
development of software. Because the turnout of specialists from higher edu-
cational institutions is not keeping up with the demand of organizations devel-
oping digital communications equipment, it has been necessary to retrain
specialists of various levels who are working on the design of digital communi-
cations systems and equipment, especially those concentrating on microprocessor
applications. In the creation of microelectronic digital communications equip-
ment based on microprocessors, the center of gravity shifts from the field of
physical modeling to that of software and microelectronics technology. On the

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basis of this fact, an analysis is made in order to determine the required level of training and skills of specialists designing this kind of equipment. The required curriculum is suggested for various specialists of various groups at an industrial enterprise which designs microprocessor systems. The need for changing the curricula of higher educational institutions is stressed. Education emphasis must be placed on the design of microelectronic digital communications equipment based on microprocessors and large-scale and ultra-large-scale integrated circuits. Figures 1; tables 1; references: 3 Russian. [116-8831]

CERTAIN ASPECTS OF PHOTOGRAPHY,
MOTION PICTURES AND TELEVISION

HOW TO ENHANCE THE EFFICIENCY OF A TELEVISION TRANSMITTING ANTENNA

NOVIKOV, P. I., engineer, RASIN, A. M., candidate of technical sciences, and
VOYTOVICH, N. I., candidate of technical sciences, Chelyabinsk

[Abstract] TV transmitting antennas must provide even field strength at all
points of reception regardless of their distance from the broadcasting center
and must match transmitter output in the 8 MHz frequency range with a standing
wave coefficient of at least 0.9. This determines the beam pattern of an
antenna in the horizontal and vertical planes with specific combinations of
antenna emitter and feeder. Series-produced antennas of transmitting stations
have a cosecant type of beam pattern, but this beam pattern is not optimum for
areas of low population. The problem of increasing the coefficient of direc-
tionality by changing the beam pattern and orientating its maximum along the
horizon can be resolved by providing synphase power supply to the central group
of emitters. By redistributing energy in space, the coefficient of direction-
ality in the proposed circuit is 30 percent higher. This change in power supply
circuitry was implemented at the Yuryuzan' Radio and TV Broadcasting Center,
showing an increase in flux density of 32 percent on the average. Figures 6;
tables 3.
[78-8617]

TUBE REPLACEMENT IN THE TV-331 TELEVISION TRANSMITTER

ZIMIN, Ye. M., chief specialist of the Central Laboratory of the Soviet-Wide
Radio and Television Transmitting Station imeni the Fiftieth Anniversary of
the October Revolution

[Abstract] A report on research done in 1978-1979 at the Central Laboratory
on substituting Soviet-made oscillator tubes for the tubes supplied with the
TV-331 television transmitter. The transmitter uses QBL 5/3500 tetrodes in the

final stages of both the video and audio sections. The final stages are driven by TBL 2/300 triodes. The closest match for these oscillator tubes now produced in the USSR is to be found in the GU-35B and GU-70B tetrodes. However, compensation is required because of differences in certain parameters, notably the input capacitance, and cooling requiremnts. In addition, there are structural differences in dimensions, lead design and the anode radiator. The necessary circuit modifications and mechanical alterations are described. The TV-331 transmitter in Dnepropetrovsk has been updated to use Soviet oscillator tubes. Figures 3; tables 2.
[140-6610]

THE ADAPTIVE PREDISTORTION OF NONSTEADY-STATE TRANSMITTED IMAGE SIGNALS

BABUROV, E. P.

[Abstract] Where predistortion is employed in order to improve the noise immunity of information transmission systems, the nonsteady-state nature of video signals which is always present to a greater or lesser extent has a considerable impact on the effectiveness of the predistortion. This difficulty can be circumvented by designing an adaptive predistortion system which takes into account any nonsteady-state behavior of the transmitted video. Possible configurations of such systems are sketched and discussed; these contain a signal source, a predistortion device with a variable transfer function, the information transmission channel, a correcting device with a variable transfer function, a spectrum analyzer, a control signal amplifier, a control channel with a relatively small carrying capacity, a playback unit and an interference source. In the case of periodic nonsteady-state video signals, it is possible to design an adaptive predistorting system in which the transmission functions of the predistorter and the corrector remain constant during the passage of the horizontal trace signal through them and change only in the intervals between the traces. An expression is adduced for the predistortion efficiency of the proposed configuration, and one is found for the maximum efficiency which is compared graphically with conventional nonadaptive predistortion in order to show the advantage of the former. Figures 3; references 10: 9 Russian; 1 Western.
[122-8225]

CONTRAST SENSITIVITY OF THE VISUAL ANALYZER RECEIVING SPACE AND TIME SIGNALS
OF AN IMAGE

GREBENNIKOV, O. F., KULAKOV, A. K. and TIKHOMIROVA, G. V., Leningrad
Institute of Motion Picture Engineers

[Abstract] The contrast sensitivity of the visual analyzer or eye is best
evaluated from the dependence of the signal amplitude on respectively the
space frequency and the time frequency. Since space and time signals in
cinematography are converted by the analyzer in the same manner, one method
can be used for determining both contrast-frequency characteristics. This
was done experimentally by measuring the minimum perceptible contrast dif-
ference between two compared images with an instrument consisting of two
illuminator-projector channels and a special device for maintenance of a
constant mean screen illuminance. The results prove that the contrast sensi-
tivity as a function of either frequency, equal to the ratio of minimum con-
trast to the frequency-dependent threshold contrast, is also accurately enough
equal to the ratio of the first threshold contrast-difference to the frequency-
dependent threshold contrast. Figures 5; references 9: 6 Russian, 3 Western.
[107-2415]

RELIEF FORMATION ON A PHOTOPOLYMER IN PRODUCTION OF RASTER SCREENS BY THE
OPTICAL METHOD

ASHUYEVA, I. A., BELOUSOV, B. I. and YATSKOVA, G. I., All-Union Scientific
Research Institute of Cinema Photography

[Abstract] An optical method of producing raster screens with a functional
orientation of elements has been proposed which involves computer-aided photo-
graphic synthesis of transparencies. The function describing the surface relief
with the appropriate boundary conditions is discretized and quantized, after
individual technological process components have been corrected accordingly.
The surface relief is transcribed onto a transparency by means of a tape-con-
trolled photorecorder. The screen material is usually a photopolymer such as
Tsellofot based on cellulose acetosuccinate and Gidrofot based on polyvinyl
alcohol. The relief formation process consists of two stages: exposure and
development. The former results in excitation of molecules and free radicals

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with subsequent photopolymerization according to the pattern set by modulation of light by the transparency. The latter includes reaction with the solvent, diffusion of the solvent, fractional extraction, gelation, and complete elution of the solvent. The high light sensitivity of Tsellofot makes this material suitable not only for binary but also semitone geometric reliefs. The frequency characteristic of the relief determines the necessary optical density of the transparency and also the correction function. The performance of a screen and, particularly, its scattering indicatrix depend on the polymer surface roughness after treatment. An experimental study of the relation between surface roughness and screen luminance has revealed the phenomenon of bilateral relief formation under unilateral exposure, to collimated ultraviolet light, hypothetically due to formation of a spatial grid. The frequency of this grid and the mass of the low-molecular polymer fraction increase with increasing incident energy density during exposure, while the subsequent diffusion of the solvent during development is limited by gelation and slows down sharply with increasing film thickness. Figures 5; references: 6 Russian.
(107-2415)

ON THE CHOICE OF THE OPTIMUM SHAPE FOR A CORRUGATED COAXIAL CABLE

PAMPU, Yu. A.

[Abstract] To optimize the corrugation profile of a coaxial cable as a function
of the geometric dimensions of an elemental cable section (period T, depth A_g and
conductor radii of d and D) requires large amounts of computer time; this paper
optimizes the profile of a corrugated coaxial cable having the following dimen-
sions: T = 3.5 mm, d = 1.6 mm, D = 3.95 mm and A_g = 2.6 mm. A numerical analy-
sis on a computer shows that the shape of the corrugation has a substantial im-
pact on the phase-frequency response of the cable in a frequency range up to
5 - 6 GHz, where there is normal of anomalous dispersion of the phase velocity;
at frequencies above 7 - 8 GHz, the shape of the corrugation has no impact on
the nature of the dispersion. Empirical expressions are adduced for the fre-
quency characteristics of the phase velocity for various corrugation shapes. A
comparison of an optimized cable against a conventional sinusoidal corrugation
shape shows that: the optimal profile is distinguished by a constant phase
velocity at frequencies up to 6 GHz; the optimum cable exhibits reduced thermal
losses. A comparison of the phase shift for one elemental section obtained
experimentally and with the proposed numerical approach showed a disparity of
no more than 0.5% in the majority of cases. Figures 6; references 9: 8 Russian;
1 Western.
[122-8225]

TO INCREASE PROTECTION BETWEEN 1 x 4 x 1.2 CABLE CIRCUITS IN THE FREQUENCY
RANGE UP TO 1300 kHz

GRIGOR'YEV, V. A., senior engineer, SNR [scientific workers section?] of Trust
"Meshgorsvyas'stroy" (All-Union State Trust for the Construction of Long-
Distance Wire Communications Structures)

[Abstract] In the construction and reconstruction of symmetrical cable lines,
the principal means of reducing interaction between circuits is symmetrization
of the cable, but its efficiency is abruptly reduced if the range of transmitted
frequencies is increased (limit of 252 kHz, or sometimes 560 kHz). The opera-
ting principle of the device is based on counterphase compensation of currents
of transient interference. The characteristics of interaction between cable
circuits in the range up to 600 kHz can be measured visually using the IKS-600
and VIZ-600 devices. In the range up to 1300 kHz, however, measurement error
increases and reaches as high as 200% at the uppermost limits. Prototype dif-
ferential KS (cable network) meters (DI-KS) and a variable counterphase circuit
were developed for the 1300 kHz frequency range. The differential meter operates
in the range of 12 to 1500 kHz; the counterphase circuit operates in the range
of 12 to 1500 kHz. Figures 4.
[78-8617]

SYSTEMS FOR TRANSMITTING, CONCENTRATING AND SWITCHING DISCRETE MESSAGES

SHVARTSMAN, V. O.

[Abstract] A combined discussion is presented of the processes of transmitting,
concentrating and switching in discrete data transmission networks. The main
emphasis is on transmission through cable communications lines, with certain
principles applying equally to the transmission of continuous information and
to transmission through radio channels. For a long time transmission and
switching systems have been studied and developed independently of one another
and concentration systems have been discussed within the framework of switching
systems, or less frequently of transmission systems, whereas the concentration
process is an independent one and has a decisive influence on the characteristics
of a communications network. It has been demonstrated that basically transmis-
sion, concentration and switching processes have much in common. A discussion
of them from a common viewpoint will make it possible to design communications

networks economically on the basis of common principles. Discussed individually are methods of dividing signals in transmission systems, load concentration systems, time-division multiplexing transmission systems, methods of distributing signals in switching systems, synchronous time-division switching, asynchronous time-division switching, and the interrelationship of concentration and switching. It is demonstrated that the method of implementing concentration determines the switching system. Of the numerous dividing and switching methods available, only a small number of them is being used at the present time. Consequently, there is a great potential for improving the economic efficiency of communications networks. The use of like methods of dividing and switching will make it possible in a switching center to dispense with the need to change from one signal division system to another and to couple transmission systems with switching equipment, resulting in a considerable reduction in the amount of switching center equipment. The asynchronous time-division switching and address time-division transmission systems should be extended to message packages and entire messages, instead of being limited to bytes and bits. This will make it possible to implement both unified division-switching systems and combined systems which switch parts of messages of various lengths, such as package switching and channel switching systems. Figures 6; references 13: 12 Russian, 1 Western.

[116-8831]

ON THE TIME DISTRIBUTION FUNCTION FOR MESSAGE TRANSMISSION IN INTERMITTENT COMMUNICATIONS SYSTEMS

KILIMNIK, Yu. P. and ARBUZOV, S. M.

[Abstract] The efficiency of intermittent communications systems, i. e. systems in which messages are transmitted only during time intervals when the communications quality is adequate, is usually based on the reception probability defined in terms of the average duration of the transmitting and interrupt intervals. The widespread use of this criterion is due to the relative simplicity of the calculations based on it, but it yields an average estimate for the communications systems and does not take into account one of the major requirements: the timeliness of message transmission. The extent to which this requirement is met can be evaluated from the message transmission time at a specified permissible confidence level. Because the distribution function of the message transmission time, which is a random quantity in this case, depends not only on the system operational conditions but also on the algorithm dictating its functioning, such an estimate is a very rough approximation and frequently

wrong. This paper derives an estimate based on values of an integral message
transmission time distribution function. The expression found for this mes-
sage function is plotted graphically for messages 3 and 5 minutes long with
identical reception probabilities and different values of the transmit and
interrupt time periods. In the case where high requirements are placed on
the message transmission time, i. e. in a range where the message transmission
time at a permissible confidence loss level is close to the message length,
for intermittent systems which provide an identical reception probability, the
best in the sense of the criterion adopted here for the efficiency will be the
one for which the values of interrupt and transmit times are the greatest; in
this case, the superiority of such a system is more pronounced, the shorter
the message transmission time at the permissible confidence loss level and the
greater the message length is. In the case of less stringent requirements on
the message transmission time, i. e. in the range of large values of the mes-
sage transmit time at the permissible confidence loss level, a system with the
lowest values of the operating and interrupt times will be more efficient under
the same conditions. The values of the message transmit time at the permissible
confidence loss level which separates the two indicated ranges are governed not
only by the reception probability, but also by the duration of the transmitted
messages. Figures 2; references 3 Russian.
[122-8225]

METHOD OF EVALUATING THE ADMISSIBILITY OF CHANNEL LOADING VARIANTS

SURKOV, Yu. P.

[Abstract] It is necessary to solve the problem of the admissibility of a
specific loading variant for a specific grouped channel, i. e., the specific
distribution of tone-frequency channels for kinds of information transmitted,
with a change in traffic when a system is in use and when designing a system.
Signal levels for some kinds of information are considerably higher than the
nominal loading level for the channel used in designing the transmission
system's equipment and the overloading of grouped channels can occur with the
simultaneous transmission of several signals higher than the nominal level in
channels of a single group. The admissibility of a specific loading variant
is determined by calculating the parameters of a group signal and comparing
them with the maximum permissible values of the parameters of a signal in the
input of a specific channel defined by the standards. A procedure is suggested
here which differs from that on which the CCITT recommendations for channel
loading are based in that it makes it possible to determine the parameters of

group signals in the input of channels with a number of channels of not less than 12, both when channels are loaded with telephone signals and with any other kind of loading. According to the existing standards a determination is made of the maximum hourly mean and maximum minute-mean power of signals in the input of grouped and line channels of transmission systems. The admissible probability of exceeding the nominal value of the maximum minute-mean power has been chosen to equal 10^{-3}. The CCITT recommendations are based on a probability of 10^{-5}, and this figure is used also in the procedure described here. The maximum instantaneous power of the group signal is calculated in terms of the maximum minute-mean power. The problem is solved by calculating the maximum hourly mean, maximum minute-mean and maximum instantaneous power of a multichannel signal in the channel's input with a specific loading variant and by comparing them with the admissible values for the channel in question. The first two parameters are defined by the standards for channels of various transmission systems and maximum permissible values of the instantaneous power are obtained from data on the development of existing transmission systems. The concept of the maximum equivalent power is used instead of that of the maximum instantaneous power, the former being defined as the effective power of the sinusoidal signal whose peak power equals the maximum instantaneous power of the signal studied. All calculations are made for hours of peak loading of the transmission system. The calculation procedure has been simplified to the maximum and provides an upper estimate of the parameters of group signals. The method has been approved at a conference of CEMA member countries for the development of standards for international communications channels and has been made the basis of the procedure for determining the distribution of tone-frequency channels in transmission systems in terms of the kinds of information transmitted. Figures 2; tables 2; references 9: 7 Russian, 2 Western.
[116-8831]

STABILIZING THE FALSE ALARM PROBABILITY BASED ON THE NONPARAMETRIC PROPERTIES OF ORDER STATISTICS FOR THE DETECTION OF A PACKET OF PULSE SIGNALS

BEZGUZIKOV, V. P.

[Abstract] Although parametric techniques can be employed in order to stabilize the false alarm probability of detectors operating with an interference background, they require that the distribution of the interference be known, something which is not always possible in practice. A method of stabilizing this probability when detecting a train of pulses is proposed, which is based on the use of the properties of order statistics and makes such regulation possible

for any interference distribution. The proposed device shows the input signal
fed through a filter matched to a single pulse and a detector to a discriminator.
The video signal readouts from the discriminator output are fed to a controlled
threshold quantizer and to a memory in which the N last readouts are stored.
The interval between readouts is chosen large enough for them to be independent.
The video signal is quantized into two levels in the quantizer. The binary
code is fed to a shift register having N - 1 outputs, with a specified delay
between the signals in adjacent register outputs. The binary video signal read-
outs are fed from the shift register to an adder; the output number of the
adder is compared in a threshold gate to the detection threshold and the deci-
sion is made whether the signal is present or absent. To stabilize the false
alarm probability, the N last video signal readouts stored in the memory are
fed to a ranking gate, in which the specified order statistics are genarated
which are used as the threshold voltage for the amplitude quantizer. This con-
figuration is analyzed and analytical expressions are given for the optimal
value of the detection threshold, the number of the order statistic used as
the quantization threshold as well as a parameter characterizing the regulation
quality. Figures 2; references: 5 Russian.
[122-8225]

OPTIMIZING THE RESOLVING POWER OF A SPECTRUM ANALYZER FOR THE DETECTION OF
NARROW BAND SIGNALS

GEL'MAN, L. M. and SADOVAYA, V. G.

[Abstract] In contrast to earlier literature which studied the detection of a
narrow-band signal using a spectral bilateral contrast algorithm, this paper
derives expressions for the detection characteristics of a spectrum analyzer
employing incoherent accumulation of estimates of the power spectrum, where
these estimates are obtained through a Fourier transformation in a form suit-
able for practical calculations. Such an accumulation is utilized in cases
where complex signals are detected with matched filtering as well as for simple
signals where the resolving power of the spectral analysis is greater than the
width of the signal spectrum. Such equations are needed in the determination
of the optimum resolution for complex signals. The detector consists of a
device to compute the power spectra in specified intervals, a device for storing
the signal over the time the signal is present and a contrast detector. A
computer plot of the false alarm probability is shown as a function of the
degree of mismatch between the optimum value of the resolution and the signal

spectrum width. The fact that an optimum resolving power can exist which is
not matched to the signal spectrum width can make it possible to achieve optimum
detection efficiency and simultaneously to simplify the detector design.
Figures 1; references: 4 Russian.
[122-8225]

THE FORMULATION OF THE PROBLEM OF ECONOMICAL DECODING OF LINEAR CODES IN A
SEMICONTINUOUS COMMUNICATIONS CHANNEL

BAKHANOVSKIY, V. I. and TURKIN, A. I.

[Abstract] The use of coded signals in radars and control and communications
systems entails considerable complexity related to optimal processing based on
a specified criterion, which in the general case results in an exponential in-
crease in the equipment volume. This paper solves this problem through the
derivation of an algorithm for the decoding of any linear code with a power law
governing the increase in equipment volume. The algorithm is optimal in terms
of a maximum likelihood criterion and applies to a gaussian channel (which
approximates the majority of real communications links). The essence of the
approach consists in solving a continuous problem of finding the extremum of
a function of several variables instead of the solving of the multiple alterna-
tive problem of signal discrimination. The technique makes it possible to use
well known methods of linear programming when decoding linear codes and set up
an iterative procedure for processing encoded signals, for which the exponential
equipment volume increase applies. The purely theoretical treatment does not
include sample calculations or experimental data. References: 2 Russian.
[122-8225]

RANK METHODS OF 'ON THE WHOLE' RECEPTION

NAUMOV, A. S.

[Abstract] The term reception 'on the whole' is used for the reception of an encoded message based on the utilization of analog quantities proportional to the a posteriori probabilities in discrete data transmission systems employing redundant coding. A variation series is used in the majority of 'on the whole' reception techniques, where this series is generated by means of arranging and numbering the components of the vector obtained at the output of the discrete channel in increasing order of their a posteriori probabilities or absolute values of the likelihood (or reliability) coefficients. The number of a component in this variation series is called the rank. Rank techniques are those methods of reception 'on the whole' in which the ranks are used for decision making concerning the transmitted coded message instead of the a posteriori probabilities or absolute values of the likelihood coefficients. Rank methods of this type include the well-known techniques of Wagner, Borodin and Chase. It is shown that Borodin's method (reception based on the most reliable symbols) does not always lead to a solution. A modified Borodin technique is proposed which always produces a solution and makes it possible to receive discrete coded messages with a minimum error probability. The purely theoretical treatment based on set theory does not include sample calculations or experimental data. References 3: 2 Russian; 1 Western.
[122-8225]

UTILIZING AN ESTIMATE OF AN UNKNOWN MODEL IN THE PROBLEM OF LINEAR FILTRATION OF MESSAGES

SHCHERBAKOV, V. Yu.

[Abstract] Although a Kalman-Busy filter algorithm provides an estimate of the useful signal (message) in real time, inaccurate knowledge of the model for the state or observation leads to additional errors and divergence of the estimate. Adaptive Kalman filter designs based on the use of estimates of unknown model parameters can provide an optimal solution which consists of incorporating

these parameters in the state vector being estimated, leading to nonlinear filtering. Because in practical applications of linear adaptive filters of this type, the manner of utilization of the estimate of the model in the filtering algorithm is usually determined intuitively, this paper proposes an approach which simultaneously optimizes the filter algorithm and its relationship to the model estimate. This is accomplished by expanding the observation through the inclusion of model estimates in it. The mathematical treatment of the case of single step prediction for a model in discrete time generates expressions defining the filter error as well as the gain in filtering precision with model estimation. The cost of this gain is a slight increase in the volume of the operations. The derived algorithm was used to estimate the state of a complex signal receiver characterized by up to 15 output logic parameters. The computer simulation confirmed the error reduction in a Kalman filter when the proposed algorithm is used and demonstrates that this result is also true for other filter parameters. The proposed approach to ordering the utilization of the estimate of an imprecisely known model parameter makes it possible to solve the problem of increasing filter precision within the framework of linear estimation without significantly complicating the algorithm. Figures 1; references: 3 Russian.
[122-8225]

DIGITAL PROCESSING OF SIGNALS IN MULTICHANNEL SYSTEMS WITH FREQUENCY-DIVISION MULTIPLEXING

VENKE, V., KURITSYN, S. A., PONOMAREV, V. I. and SOSNOVSKIY, I. Ye.

[Abstract] A review is presented of methods of digital processing of signals used in the equipment of multichannel transmission systems with frequency-division multiplexing. Discussed in detail are the direct replacement of analog filters separating the single sideband signal by digital band filters, the digital formation of a single sideband signal by means of a Weaver modulator, and the group processing of a signal for the purpose of utilizing digital equipment more effectively in forming a group signal. These methods individually eliminate in whole or in part the disadvantages of analog filters, which include considerable linear distortion, insufficient stability and duplication of the characteristics of analog filters, and the complexity of fabricating filters separating a single sideband. All the digital methods developed thus far impose high requirements on the speed of response of digital circuit elements, i. e., from 0.4 to 3.5 μs per single act of multiplication. In addition, the analog-digital converters and digital-analog converters must have a word

length of 15 to 16 bits. This makes it hard for the digital equipment proposed to compete with classical methods of equipment design. Judged the most promising are group methods of processing signals in which signals of the entire primary group (12 channels) or of the secondary group (60 channels) are processed by a single processor. The problem faced here is that of developing sufficiently inexpensive analog-digital and digital-analog converters. In creating t' 'e processor it is necessary to find an operating algorithm with which the key components can have a relatively low speed of response. The combined processor should consist of microprocessors and an important research goal is to determine the requirements for these. The solution to this problem will make it possible effectively to match systems with time-division and frequency-division multiplexing. Also judged quite promising is the digital-analog processing of signals, whereby signal counts are stored in analog elements and resistive voltage dividers are used as constant-factor multipliers. The need to improve methods of the optimal design of digital and digital-analog filters is stressed. In this regard it is important to develop analytical methods to replace the numerical methods currently employed, in order to obtain clearer results and to reduce computing time considerably. Figures 4; references 15: 7 Russian, 8 Western.
[116-8831]

ESTIMATING THE EFFECTIVE ATTENUATION OF CONNECTING LINES AND RECORDING-AND-CONNECTING LINES OF URBAN TELEPHONE NETWORKS

ANDREYEVA, L. V., KALLER, M. Ya., KOPACHEVA, Yu. I., PARFENOV, Yu. A. and SANKOVSKIY, E. I.

[Abstract] Urban telephone networks are divided into non-multiexchange and multiexchange, and the latter into networks with toll switch planning and without it. Connecting lines connect district automatic telephone exchanges, district and tandem automatic telephone exchanges, and incoming-message and outgoing-message exchanges. Recording-and-connecting lines connect district automatic telephone exchange users with an automatic long-distance telephone exchange. A discussion is presented here of estimating the effective attenuation of combined connecting line and recording-and-connecting line circuits including low-frequency cables, KRR (cable-radio relay) (KAMA) and IKM-30 transmission systems, bridge amplifiers, coil-loaded cables and networks of various automatic telephone exchanges, taking into account the mismatch of the input impedance of circuit elements. Specifications for the effective attenuation of the transmission circuit of a connecting line and recording-

and-connecting line have been set on the basis of ensuring normal functioning
of the voice channel in the 0.3 to 3.4 kHz frequency range. Attenuation has
been distributed over sections of the long-distance and local voice channel for
the Statewide Automatically Switched Telephone Network (OAKTS) system. In
estimating the effective attenuation of a section of a channel equipped with
bridge amplifiers, their characteristic impedance at all frequencies is assumed
to be equal to the wave impedance of circuits of the cable to which the ampli-
fier is connected. The amplifier-line connection is not taken into account in
calculating the change in effective attenuation. The residual attenuation of
the section of the line with the amplifier is used as the attenuation of the
combined channel. The effective attenuation of a connecting line and recording-
and-connecting line channel composed of non-coil-loaded cables, bridge ampli-
fiers and tone-frequency channels equipped with KRR equipment is estimated
simply by summing their characteristic attenuation at a frequency of 0.8 kHz.
In the case of combined channels containing coil-loaded cables, the effective
attenuation is estimated at a frequency of 0.8 kHz, at which the attenuation
of the voice channel is checked, and at the operating frequencies of code
receivers, i. e., 0.7, 0.9, 1.1, 1.3, 1.5 and 1.7 kHz. The estimating proce-
dure described is based on regarding connecting lines and recording-and-connec-
ting lines as combined channels in which the connected elements are represented
by cable circuits, automatic telephone exchange switching equipment, low-
frequency bridge amplifiers and transmission system channels. Tables 3;
references: 3 Russian.
[116-8831]

PRINCIPLES OF ORGANIZATION OF THE COMBINED OPERATION OF QUASI-ELECTRONIC
AUTOMATIC TELEPHONE EXCHANGES AND AUTOMATIC LONG-DISTANCE TELEPHONE EXCHANGES
OF VARIOUS SYSTEMS

GUAN, T. I., IL'INA, L. D. and PEKARSKIY, Ye. B.

[Abstract] The development of the long-distance telephone communications net-
work will entail an increase in the number of connections made automatically.
Automatic long-distance telephone exchanges (AMTS's) will be supplemented with
quasi-electronic system AMTS's (AMTSKE's). The problem is discussed of coord-
inating the operation of various AMTS's with local telephone networks furnished
with decade step-by-step, crossbar and quasi-electronic system exchanges.
Features of the organization of long-distance communications according to the
zone principle are discussed. According to this principle, in each zone there
is one or more AMTS's which make connections directly for local telephone

network users in the zone and serve as terminal long-distance exchanges for the entire zone. With several AMTS's in a zone, each supports a group of local networks, servicing its outgoing messages. Each AMTS services incoming messages for all local networks in the zone. An AMTS is reached by dialing an "8." In order to select the optimal variant for the method of interaction between an ATSKE [quasi-electronic automatic telephone exchange] and an AMTSKE, an analysis is made of methods of interaction between ATSKE's and ATMS-2, 3's and ARM-20's, i. e., crossbar systems, with special attention to organizing outgoing automatic long-distance communications. In the future telephone sets with dials will be replaced by touch-tone sets. It takes a user 0.5 s to "input" a character with the touch-tone system, while it takes 1.2 s for transmission of this character by means of decade pulses to the AMTS. It is suggested that the long-distance number called be stored at the ATSKE and transmitted to the AMTSKE by means of a multifrequency code employing the pulse packet method. When an ATSKE interacts with an AMTS-2, 3 or an ARM-20 system, the expansion of an abbreviated long-distance number into the full number must be performed at the ATSKE, since these types of AMTS's do not have this capability. Users of ATS's [automatic telephone exchanges] of all types must dial an "8" in front of the abbreviated number when using the abbreviated long-distance dialing service. Figures 4; references: 2 Russian.
[116-8831]

LINE CIRCUIT EQUIPMENT OF THE K-1920P TRANSMISSION SYSTEM

LUGOVSKOY, N. Ye. and STEPANOV, G. N.

[Abstract] A description is given of line circuit equipment of the Soviet-developed K-1920P transistorized transmission system which is intended for use in new cable communications trunk lines and for replacement of the K-1920 tube equipment now used. An advantage of the new equipment is the 240-km distance between attended repeater stations. The K-1920P line circuit equipment combination contains high-frequency line circuit equipment including line circuit equipment for the K-24R distribution system and remote power equipment, as well as service communications equipment; remote control equipment; equipment for adding, switching and shunting a television channel; phase correction equipment; equipment for leading a cable into an uncontrolled repeater station; and auxiliary equipment, such as test equipment and equipment for lines connecting the line circuit to terminal transformer equipment and to television equipment, eqiupment for separating from the line frequency spectrum two 60-channel groups which are the lowest for the spectrum and equipment for

converting the video spectrum of television signals and sound track signals into the line frequency spectrum. The line circuit's high-frequency equipment is designed for operation through coaxial cables with pairs having a normal diameter of 2.6 and 9.4 mm, i. e., through KMB-4 cables. The lower part of the line frequency spectrum is intended for the operation of noise power monitoring equipment. The main uncontrolled repeater stations of the system compensate the attenuation of a boosting section of cable 6 ± 0.3 km long at a ground temperature of + 8 °C. The only control equipment they contain is that which compensates for the difference in the length of booster sections. Regulating uncontrolled repeater stations are installed after every three main stations and perform the same functions, in addition to that of automatic gain control. The automatic gain control equipment operates with a change in temperature of the ground and in the level of the 8544-kHz frequency corrector's current. The attended repeater stations used in the K-1920P transmission system include ones without additional functions, ones which shunt the TV channel, which isolate groups of telephone channels, or which isolate and add a TV channel. A distinctive feature of the K-1920P equipment is the high degree of unification with the equipment of the same kind of the K-3600 transmission system. State tests were performed on models of the equipment in an experimental section of a trunk line 115.7 km long containing 14 main and five regulating uncontrolled repeater stations, as well as terminal station and attended repeater station equipment. The difference between the amplitude-frequency characteristic of the gain of line boosters and the attenuation of cable sections is not greater than 0.1 dB. The equipment ensures high stability of the line circuit's overall attenuation. The circuit's dynamic characteristics conform to CCITT standards. Figures 3; references 4 Russian.
[116-8831]

AUTOMATIC MONITORING OF BROADCAST SIGNAL LEVELS

BAKHVALOV, L. I., Shop Chief of KRA (Switching-Distributing Control Room) of SUR-2 (Union Center for Radio Communication and Radio Broadcasting-2), and IOFFE, M. G., candidate of technical sciences, chief designer of a project, Central Design Bureau, USSR Ministry of Communications

[Abstract] Broadcast signals must be continuously monitored, because prolonged reduction in levels results in undermodulation of broadcasting transmitters and a reduction in the zone of confident reception. The signal-to-noise ratio also deteriorates at reduced signal levels. Excessive signal levels result in over-modulation, increased nonlinear distortions, and transmitter breakdown. The switching-distributing control room (KRA) contains a quasi-peak level meter in the control console, but the current staff level can not monitor all broadcasts. The best solution is automated monitoring using the KDU-6 developed by the

Central Design Bureau of the USSR Ministry of Communications and manufactured at the First Moscow Experimental Plant "Promsvyaz." The device is designed for automated monitoring of the transient level of broadcast signals. The "excess" signal is transmitted if the maximum signal level is not at least 4 times greater than the rated value by 4 dB for one minute. The "reduced" signal is sent if the maximum signal level is reduced by 3 dB for six minutes. The Union Center for Radio Communication and Radio Broadcasting (SUR) Number Two utilizes four KDU-6 devices. Some manufacturing errors were found: when replacing printed circuit boards in the KDU-6 the integrity of the leads is disturbed; metallization of holes in the PCBs is of poor quality; some units are delivered without tuning, with defective parts. The use of these monitors frees personnel from monotonous and tedious observation of the meters and enhances quality and reliability of program transmission. Figures 5.
[78-8617]

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES,
CAVITY RESONATORS AND FILTERS

INTELLIGENT SELECTION OF PARAMETERS OF CHOKE COILS IN PULSED ENERGY CONVERSION
EQUIPMENT

GLEBOV, B. A.

[Abstract] Equations are arrived at which make it possible with a relatively
small number of computations to calculate for the specific operating conditions
of an energy conversion unit, a choke coil of minimum size and weight construc-
ted by using cores of a specific configuration and magnetic material and guaran-
teeing minimum lost power. The procedure for optimal selection of the choke
coil's parameters takes into account the nonlinearity of the magnetic charac-
teristics of its core as applied to the most often encountered case when the
current of the choke coil's winding rises and falls according to a law close
to linear. Equations are derived in order to approximate the magnetization
characteristics of magnetic materials for the purpose of representing in analy-
tical form the dependence of the inductance of a choke coil on the current in
its winding. The condition for linearity of the choke coil's magnetic charac-
teristic is formulated as a slight dependence of the coil's inductance on the
amplitude of the current flowing through its winding. Equations are derived
which make it possible to find the minimum possible number of turns of the choke
coil's winding. Losses of energy in the coil are made up of losses of energy
in its core and winding, and the former consist of two components, the first
being related to the hysteresis nature of the process of alternating magneti-
zation of the core. The second component is caused by eddy current and magnetic
viscosity phenomena. The key design data for the choke coil are determined in
two steps. First the core is selected and, second, a determination is made of
the size of the nonmagnetic gap in the core and of the cross section of the
winding's wire. In selecting the core, a core is first selected at random from
the standard series produced by industry. Then a determination is made of the
minimum possible number of turns of the coil's winding. Then a computation is
made of the dependence of the power dissipated in the coil on the number of
turns. Having determined the optimal number of turns with which the least
power is dissipated in the coil, the power dissipated is compared with the
maximum power dissipated by the coil with a specific temperature of the environ-
ment and maximum temperature at the coil's "hot" point. The optimal type size

of the core is that with which $0 < (P_{d.\,pred} - P_d)/P_d \ll 1$, where P_d is the power dissipated by the coil and $P_{d.\,pred}$ is the maximum power d_ssipated under the temperature conditions named. Figures 3; tables 1; references: 12 Russian.
[116-8831]

THE DESIGN OF TUNABLE FILTERS AND EQUALIZERS BASED ON THE PRECISION CHARACTERISTICS

KRIVOSHEYKIN, A. V.

[Abstract] The stringent requirements placed on the performance of filters and equalizers are usually met by alignment during fabrication. However, even with error-free alignment procedures, there are still errors in the response characteristics caused by imprecision in the manufacture of the components. This paper develops a technique for calculating the tolerances of LC and RLC filters and equalizers, for which the errors in the output characteristics do exceed the permissible values following alignment. All tolerance computation techniques are based on equations which relate the deviations in the values of the ordinates of the characteristics to the deviations in the values of the component parameters responsible for them. The mathematical approach is illustrated by the calculation of the tollerances for the components of an n-section phase corrector. Expressions are derived for the tolerances of the constituent capacitors and inductors. The proposed technique can also be extrapolated to LRC circuits for the case where not all of the transfer function are subject to tuning. A similar situation arises in piezoelectric filters where it is possible to have a considerable change in the capacitance and inductance of the resonator in the equivalent circuit, while the tuned frequency of the circuit is maintained with a high degree of precision. Figures 2; references 12: 8 Russian; 4 Western (in translation).
[122-8225]

27

A SPECTRAL METHOD OF DIGITAL FILTER SYNTHESIS

SMIRNOV, Yu. M., VOROB'YEV, G. N. and SYUZEV, V. V.

[Abstract] While the majority of digital filter synthesis techniques are based on signal representations as functions of time or a Fourier series expansion, this paper proposes an analytical procedure where the signals are expanded in an arbitrary orthogonal system of base functions. It is assumed that the filters are used to estimate the parameters of a useful input signal against a background of random noise. The analysis applies to the class of nonrecursive filters where the optimization parameter is a minimum of the random error dispersion with the systematic errors equal to zero. The algorithm derived for the determination of the weighting function of the filter is applied to the specific case of poly-nomial filters and it is shown that the use in this case of Walsh-Paley base functions yields an extremely simple algorithm for the design of such filters employing digital devices with binary arithmetic. A simple expression is ad-duced for the weighting function vector in the case of a Walsh base and noted that this technique generates simpler devices than existing methods. No figures or experimental checks of the theory are cited. References: 4 Russian. [121-8225]

THE DEAD ZONE OF A LASER ANGULAR VELOCITY SENSOR

YENIN, V. N. and KUZNETSOV, V. G.

[Abstract] The basic components of a laser angular rate transducer are a ring
laser, a bias frequency generator and a digital system for measuring the dif-
ference frequency. The dead zone where the ring laser exhibits insensitivity
has been analyzed in earlier literature, but the influence of the digitization
of the phase difference between the opposing waves in the ring laser was not
taken into account. This paper is an analytical estimation of the dynamic dead
zone of such angular rate sensors with digital signal processing. Equations
are written and solved for the phase difference, which are supplemented with
expressions taking into account amplitude quantization of the phase with a
given step and a digital signal processing algorithm for a given number of
pulses in a half-period of the alternating bias frequency. A sample calcula-
tion for the case where the quantization step in the phase difference is pi
and the synchronization range of the ring laser is 10^4 sec^{-1}, shows that the
asymptotic estimate of the region of residual insensitivity is 0.04 Hz. It
is noted that the final expressions derived here for the dead zone are simpler
than previous ones and suitable for use in engineering practice. Figures 1;
references: 2 Russian.
[121-8225]

ELECTRICAL ENGINEERING EQUIPMENT AND
MACHINERY: APPLICATIONS AND THEORY

USE OF VARIABLE ELECTRIC DRIVES IN AGRICULTURE

MUSIN, A. M., doctor of technical sciences, PAN'KIN, V. V. and ROZHDENSTVENSKIY,
I. V., candidates of technical sciences

[Abstract] Variable electric drives are used to control the flow of feed for
horned cattle, but the metering out of stemmed feeds is more difficult to ac-
complish. Domestic industry has yet to produce a single prototype device for
feed control of such materials which prevents the establishment of production
lines for manufacture of feed mixtures. Alternating-current prototype variable
drives have been developed for some machinery: the TZB-30 pneumatic trans-
porter loader, AVM-3 and AVM-5 drier drum loaders; vegetable driers, grain mill
loaders, water flow controls, pump water pressure sensors, axial fans, and
silage hoppers. Thyristor frequency converters types TPCh and EKT are manu-
factured with ratings of 40 kVA and more. Thyristor controlled drives have
infinitely variable speeds, which can be adapted to the practical needs of each
application. Tables 1; references: 8 Russian.
[74-8617]

OUTLOOK FOR ELECTRIFICATION OF AGRICULTURAL MACHINE CONSTRUCTION AND THE NEED
FOR ELECTRICAL EQUIPMENT

PRONICHEV, V. K., engineer

[Abstract] A general survey is made of agricultural machine construction and
the need for electrical equipment. Since the March 1965 plenary session of

the CPSU basic industrial capital in public agriculture has increased by a factor of 2.8. The agricultural machinery pool is virtually brand new. Agriculture now requires about 6 times as much electrical energy. In recent years the average annual volume of agricultural products reached 116 billion rubles, i. e., it is 1.5 times greater than in the years preceeding the March 1965 plenary session. The current goal is to expand agricultural output in nearly constant areas, increasing production by a factor of 1.5 to 2 and reducing the amount of the work force to about two-thirds of its current level. The sector now produces 240 electrified agricultural machines, and by the end of this five-year plan there will be 300 of them. There are too many different types of electrical motors produced, with different shaft diameters and attachment points, which require a realignment of production and encumber spare parts maintenance. Agricultural machine cables are not of high quality. Domestic agriculture machinery can be improved by means of standardization of connecting pieces, electrical motors, and the like.
[74-8617]

BASIC REQUIREMENTS IMPOSED ON LOW-VOLTAGE EQUIPMENT AND COMPLEX CONTROL DEVICES USED IN AGRICULTURE

BELENOV, A. T., candidate of technical sciences, and IVANOV, V. V., engineer

[Abstract] Most electrical equipment used in agriculture consists of low-voltage apparatus (NVA) and low-voltage complex control devices (NKU). In 1980 the percentage of electrical equipment in the total volume of agriculture energy capacities should reach 22 percent: it will be 3.7 times as great as in 1970, whereas overall energy capacities in agriculture will increase by a factor of 2.1. High humidity (up to 100 percent), wide ambient temperature fluctuations (from $-30^{\circ}C$ to $+40^{\circ}C$), intense dust (up to 1.3 grams per cubic meter), presence of ammonia (up to 0.09 grams per cubic meter) and hydrogen sulfide (up to 0.08 grams per cubic meter) and so forth have an adverse effect on NVA and NKU and greatly reduce their service life. Improper design of thermal relays and their incorrect use are responsible for the fact that 67 percent of all I profile motors and 24 percent of all II profile motors do not have overload protection; only 67 percent of the thermal relays disconnect the motor at 120 percent of rated load. A common type of emergency condition in agricultural equipment is phase loss, but only in 21 percent of the cases do thermal relays protect against such conditions. Figures 1; references: 5 Russian.
[74-8617]

SPECIFICS OF UTILIZATION OF NKGH-11D STORAGE BATTERIES

OYSGEL'T M. G., senior engineer of the laboratory at the "Mezhgorsvyaz'stroy" (All-Union State Trust for the Construction of Long-Distance Wire Communications Structures) Trust, and ROMBRO, V. S., candidate of technical sciences, deputy chief of the laboratory

[Abstract] The article discusses the peculiarities of working with storage batteries made up of NKGK-11D sealed cells with dense packing of plates. These cells measure 33 x 49 x 120 mm and weigh 440 g. Energy capacity is 100 kJ/kg, and electric capacity is 11 ampere-hours assuming prolonged discharge by a current of less than 2 A. Strict adherence to specified operating conditions is necessary in using batteries made up of these cells. It is especially important not to overcharge the batteries. When several cells are connected in series, the slight differences in parameters of the individual cells may cause problems in adherence to the proper discharge schedule. To prevent such problems, it is recommended that the cells be connected into a series battery only after two charge-discharge cycles. On the second discharge cycle, the time required for the cell to reach a potential of 1 V is recorded. When making up a battery, care should be taken that the capacities of the individual cells are the same within ±0.2 ampere-hour, or more preferably within ±0.1 ampere-hour. Cells with capacity of less than 11 ampere-hours are put through another cycle, and in case of unsatisfactory performance are discarded. Properly assembled batteries can be used down to 1 V per cell without undesirable effects. Precautions are given for preventing overcharging and for protecting from leakage. Figures 7.
[140-6610]

ELECTROTHERMICS IN AGRICULTURAL PRODUCTION

BORODACHEV, A. S., director VNIIETO (All-Union Scientific-Research Institute of Electrothermal Equipment) and KAGAN, N. B., chief designer

[Abstract] Agricultural electrical energy requirements will roughly double in the Tenth Five-Year Plan. Low-temperature heating is the most promising sector of electrothermics: in the past 15-20 years in the majority of developed countries, among them the USSR, the relative proportion of electricity used to generate heat increased by a factor of three to ten and should continue to increase rapidly. New prerequisites for more rapid introduction of low-temperature heating include: centralization of electrical supply and improved technical and economic indicators of electrical energy production and distribution; increased demand for heat supply quality; intensification of fluctuating energy demand; rapidly expanding environmental protection requirements imposed on energy users. Various kinds of heaters are considered: hot air, hot water, steam, convection heaters, etc., and their effects on various types of livestock maintenance areas. Figures 6.
[74-8617]

EXPERIENCE IN CREATING AND OPERATING HYDRAULIC TURBINE EQUIPMENT AND OUTLOOK OF DEVELOPMENT

OGURTSOV, A. P., chief engineer, and BABANOV, O. S., chief designer of hydraulic turbines

[Abstract] By the end of the 10th Five-Year Plan, production of electric energy will reach (1340 to 1380) x 10^6 kilowatt-hours, approximately 15-16% of which comes from hydraulic generation sources. The largest hydraulic power stations in the world are the Krasnoyarsk, with twleve 500 MW radial-axial turbines and the Volzhsk imeni 22nd CPSU Congress, equipped with 22 rotary blade 126 MW turbines. At present more than 120 Kaplan type turbines with rotor diameters of over 9 meters have been produced. These turbines are typified by a single thin-walled shaft directly connected to the generator rotor bushing. Rotating blade turbines with diagonal rotors have radial (cylindrical) guides, a spiral chamber, stator and suction tube. Horizontal capsule rotary

blade turbines have a maximum rotor diameter of 7.5 meters. The stator consists of 8 radial columns and has a diameter of 15 meters. The most powerful hydraulic turbines constructed in the Soviet Union are the turbines at the Sayano-Shushenskiy hydroelectric power station. Their capacity is 650 MW and they rotate at 142.8 rpm, with peak efficiency of 96 percent. The most advantageous combination is steam turbine and gas turbine equipment. Figures 4; references: 8 Russian.
[76-8617]

FULL-SCALE TESTING OF THE HYDRAULIC PLANT OF THE JENPEG HYDROELECTRIC POWER STATION

GUSHCHIN, M. V., engineer, PYLEV, I. M. and SIDORENKO, V. F., candidates of technical sciences

[Abstract] The Leningrad Metal Plant and the LEO [Leningrad Electrical Department?] "Elecktrosil" have jointly manufactured six horizontal capsule hydraulic plants for the Jenpeg hydroelectric power station on the Nelson River in Canada. Their rated capacity is 28.9 MW, rotor diameter 7.5 meters, rate of rotation 62 rpm, and capsule diameter 9.4 meters. Jenpeg has significant seasonal variations in head ranging from 4.88 to 11 meters. Maximum efficiency in propeller modes for most angles of blade installation is higher than the efficiency for the corresponding capacity obtained in turbine operation in terms of fixed combinatorial relationships. Under most conditions these differences are less than one percent. Under combined conditions the rotor chamber and turbine bearing vibration increases in direct proportion to output. Preliminary tests indicate that the hydraulic plants are operating satisfactorily. Figures 2; tables 1.
[76-8617]

A METHOD OF DEVIATION MEASUREMENT BASED ON THE INSTANTANEOUS FREQUENCY ZERO CROSSING

SHPAN'ON, P. A., PAVLENKO, Yu. F. and RAYKHMAN, A. F.

[Abstract] The use of an oscilloscope to measure frequency deviation is based on shifting the FM signal by an amount equal to its deviation and reading the zero of instantaneous frequency difference of the converted signal from the characteristic figure on the screen. While this approach makes it possible to measure the up and downside peak frequency deviations with an error of 1% or less, the majority of such techniques provide this high precision only in the case of a harmonic modulating signal and require large modulation indices. This paper proposes a refinement of the method which permits both precise measurement of the frequency deviation at low modulation indices and is a true peak method, independent of the modulating signal waveform, unlike the method of Bessel function zeros or other spectral methods. The circuit configuration for the experimental test of the approach is shown and the measurement errors are evaluated. The mean square value of the random error for modulating frequencies of 10 KHz or more and ratios of the frequency deviation to the modulating frequency of 1 or more did not exceed 0.2%. The method made it possible to design a frequency deviation calibrator for discrete values of the modulation index of from 1 to 10 - 15. Figures 4; references: 1 Russian.
[122-8225]

THE DETERMINATION OF PARASITIC CAPACITANCES IN RADIOELECTRONIC DEVICES

RUSIN, Yu. S.

[Abstract] The determination of capacitive coupling in the design of printed
and integrated circuit film devices is a practically insoluble problem in elec-
tromagnetic field theory because of the complexity of the geometry. For this
reason, an approximate method is used to find the partial capacitances of elec-
trodes arranged in layered media (IC film structures) which permits a consider-
able reduction in the volume of computer operations as compared to other methods
found in the literature. The proposed model consists of an arbitrary number of
dielectric layers, between which flat conductors are positioned (with a theoreti-
cal thickness of zero); the width of the conductors and the spacings between
them are much less than their length. A mathematical method employing potential
and charge matrices for the determination of the partial capacitances is dis-
cussed; the essence of the approach involves representing any electrode having
a complex configuration as several simple parts. The purely theoretical dis-
cussion is not supplemented with either sample calculations or experimental data.
References: 5 Russian.
[122-8225]

OPTOELECTRONICS, QUASI-OPTICAL DEVICES

PROBLEMS IN OPTOELECTRONIC INSTRUMENT BUILDING

LAZAREV, L. P.

[Abstract] Optoelectronic devices operating at optical wavelengths between the far infrared and the ultraviolet can perform the most diverse functions: 1) Make thermal maps of cloud cover and the earth's surface from space and map vegetation, soil, agricultural areas and geological structures; 2) They can be used as contactless optoelectronic transducers for measurement, recording and control of high speed and high temperature processes in gas dynamics, metallurgy, vacuum welding, explosive and nuclear reactions, etc.; 3) Laser gyros can improve over the precision of mechanical gyros by two to three orders of magnitude; 4) They can be used for optical communications lines such as the telephone trunk from Krasnogorsk to Moscow as well as other high capacity transmission links using coherent light; 5) Optical "image logic" in computers may boost computer speed up to 10^{17} to 10^{20} operations/sec; and 6) Holographic instrumentation systems, etc. The very general discussion of the applications of these and other optoelectronic devices is followed by a review of the requirements for the design and industrial production of such devices in general. The major criterion in evaluating the quality of a given device is the ratio of the extent to which the device meets the functional engineering requirements to its cost. To improve time utilization efficiency in the design process, it is expedient to run the planning of optoelectronic system components concurrently with the analysis of some of these components. The fabrication of a prototype can be started prior to the completion of the design work despite a certain risk and the possibility of having to rework it. An important tool in accelerating optoelectronic development is automatic computer analysis and system synthesis as well as mathematical or partial scale physical modeling. The time needed for the design and setting up series production of optoelectronic devices can be considerably curtailed through the creation of a system of universal assembly and production technology accessories and test instruments and jigs, as well as standardization of the components of

a family of devices. The concomitant requirements placed on optoelectronic system engineers are basically that they have a solid scientific and engineering foundation not just an optoelectronic systems, but also in data processing systems and a mastery of technical language of a number of narrow fields in science and engineering related to optoelectronic components and the automated design systems for such components. References 3: 2 Russian; 1 Western in translation.
[121-8225]

OSCILLATORS, MODULATORS, GENERATORS

A HIGH-POWER MAGNETIC-THYRISTOR GENERATOR OF HARMONIC HIGH-FREQUENCY
OSCILLATIONS

DUBINKER, A. S.

[Abstract] The frequency range of a thyristor high-frequency generator can be
extended from tens of KHz up to a few MHz by incorporating magnetic switches
such as are usually employed in magnetic modulators. The circuit configuration
shows a thyristor inverter consisting of a storage capacitor and four thyristors
as well as charging chokes; the thyristor inverter drives a second magnetic
stage consisting of a pair of transformers and magnetic compression networks
formed by capacitors and nonlinear chokes. This magnetic circuitry in turn
drives a parallel RLC resonant circuit. The detailed discussion of the circuit
operation adduces analytical expressions which define both the component para-
meters and such circuit parameters as frequency and efficiency. An experimental
check showed good agreement with the design figures: 1) The measured efficiency
of the generator at frequencies of about 500 KHz is 0.6. The losses can be
further reduced by improving the magnetic cores and the appropriate choice of
capacitors, as well as reducing the length of the hookup wiring. It is antici-
pated that the efficiency can be boosted to 0.7 - 0.75, i. e. the level of con-
temporary vacuum tube transmitters. 2) One thyristor inverter with four
TCh-100 thyristors can deliver 1.6 - 2.0 KW to a load, i. e. to obtain the
requisite power in the load, the number of inverters should be approximately
equal to half of the power in kilowatts. Figures 4; references: 7 Russian.
[122-8225]

HIGH-VOLTAGE RAMP VOLTAGE GENERATORS DESIGNED AROUND FIELD EFFECT DEVICES

BONDAR', V. A.

[Abstract] A linear sawtooth waveform generator is designed around discrete components using low-voltage unipolar and high-voltage bipolar transistors in order to boost the output amplitudes over those attainable with traditional integrated op amp approaches. A schematic of the generator is shown along with design equations for the stability criteria and nonlinearity. Design parameters which maximize the output amplitude and minimize the nonlinearity are defined and an experimental check was made using a device with the following parameters: a supply voltage of +70 v, an output pulse width of 50 to 100 microseconds, a repetition rate of 8 to 18 KHz, an output amplitude of 50 to 55 volts. The lack of high voltage bipolar low power p-n-p transistors limits a further increase in the linear output voltage. The use of KT605 transistors or similar devices could increase the amplitude to 300 v. The proposed generator is simple and reliable, with a good load capacity and linearity and has a good power consumption efficiency. All of the generator components, with the exception of the pulse shaping capacitor and a variable resistor for amplitude control, meet the requirements of hybrid technology. Figures 2; references: 3 Russian. [122-8225]

POWER SYSTEMS (INCLUDING EFFECT OF
VARIOUS ITEMS ON POWER TRANSMISSION)

UDC [621.316.543:621.382.233.026:621.314.21].001.1

OUTLOOK FOR USE OF THYRISTOR DEVICES FOR REGULATION UNDER LOAD IN AGRICULTURAL
ELECTRICAL NETWORKS

GUREVICH, V. I., engineer

[Abstract] Most agricultural regions in European Russia use a three-stage
electrical power supply system of 110/35/10/0.4 kV with a distributing network
voltage of 10 kV. Without voltage control it is almost impossible to provide
acceptable voltage conditions for the user without a significant increase in
cost. The problem of creating contact-free thyristor transformer selectors has
been successfully solved by the VIESKh (All-Union Scientific-Research Institute
for Electrification of Agriculture) and VIT (All-Union Scientific-Research
Planning-Design and Technological Institute of Transformer Building) institutes,
which developed thyristor RPN (regulation under load) devices for installation
on the 10 kV side of 1000 kVA power transformers. The most useful RPN devices
would be used in 100/35 kV and 30/0.4 kV transformers. In transformers of up
to 6300 kVA capacity, the thyristor RPN device should be installed on the 35 kV
side, but on 10,000 kVA or larger transformers it should be installed on the
100 kV side. The power circuits of the RPN device must be improved in order to
reduce the number of RPN devices and to increase stability under emergency con-
ditions. The thyristors must be protected against surges and external short-
circuits. Figures 3; references: 8 Russian.
[74-8617]

EFFECTIVENESS OF ORGANIZATIONAL MEASURES TO REDUCE LOSSES OF ELECTRICAL ENERGY
IN ENERGY SYSTEM NETWORKS

ZHELEZKO, Yu. S., candidate of technical sciences, VNIIE (All-Union Scientific-
Research Electrical Power Institute)

[Abstract] One way to reduce losses of electrical energy in energy networks is
the optimization of line interface points, where power consumers can obtain
power supply from two different step-down substations. This is most effective
in urban grids of 6 to 10 kilovolts. Substantial reduction of loss of electrical
energy can be achieved by disconnecting one of two or more transformers during
off-load periods. A basic organizational measure in 380V grids is redistribu-
tion of loads among phases. The most effective way to reduce loss is optimiza-
tion of steady-state networks in terms of reactive capacity. VNIIE's B2 program
and the SDO [expansion unknown] of Irkutsk Polytechnical Institute are recom-
mended for optimum voltage regulation. Objective data must be available about
possible additional reduction of losses in order to organize work on loss reduc-
tion. The total number of power centers of various voltages and the number of
power centers whose voltages are being optimized must be known.
[77-8617]

EFFECTIVENESS OF TECHNICAL MEASURES TO REDUCE LOSSES OF ELECTRICAL ENERGY IN
ENERGY SYSTEM NETWORKS

VOROTNITSKIY, V. E., candidate of technical sciences, VNIIE (All-Union Scientific-
Research Electrical Power Institute)

[Abstract] Reconstruction, modernization or construction of electrical networks,
and replacement or installation of additional equipment are technical measures
used to reduce losses of electrical energy. Technical measures to reduce losses
in networks must be chosen on the basis of achieving the maximum national eco-
nomic effect while satisfying conditions of reliability of electrical supply and
the quality of electrical energy. Static capacitor batteries can be used to
balance out power fluctuations. Optimization of transformer loads in substations
or replacement or installation of additional transformers can greatly reduce

losses. Optimization of network load by construction of new electrical power transmission lines and substations and conversion of grids to higher nominal voltage are among measures which reduce losses. The payback period of capital investments serves as an arbitrary boundary of division of technical measures into measures directly aimed at loss reduction and measure with concomitant loss reduction. Tables 2; references: 2 Russian.
[77-8617]

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AIRCRAFT-TO-AIRCRAFT RADAR SYSTEM DESCRIBED

Moscow GRAZHDANSKAYA AVIATSIYA in Russian No 1, Jan 81 p 19

[Article by N. Bondarchuk, chief of ATB (air maintenance facility) sector, city of
Mirnyy: "With Onboard Radar"]

[Text] The constantly growing requirement for air transportation and an increase in the
amount of work involving the use of aviation in the national economy represent an
objective prerequisite for a continuous increase in air traffic both in individual
regions and throughout the country as a whole. This is why it is such an urgent
matter to increase the reliability of control over the position of craft in the air
space and, above all, their position with respect to each other.

By monitoring a flight with the most sophisticated radar, the UVD [air traffic con-
trol] dispatcher can determine the movement of aircraft in the air with a high
degree of precision. Further improvement in flight control from the ground, then,
is the primary reserve for improving supervision over the craft, but this matter
can be resolved satisfactorily by the crews themselves as well. In particular, a
crew obtains very valuable information in this regard by continuously monitoring
radio communications with the ground, with air traffic control points.

It is possible to monitor aircraft in the air using equipment aboard modern air-
ships. In particular, the airborne weather radar (BRLS) provides information about
the surrounding air space. Aircraft flight operation manuals provide certain
recommendations for use of the airborne radar to detect aircraft aloft and prevent a
dangerous approach to them. But these recommendations are based on the fact that,
using the BRLS, it is possible to determine with sufficient accuracy the position of
the detected airship by range and azimuth, while the accuracy of determining the
airships' mutual location by elevation (altitude) is not considered.

Is it possible to determine this accuracy and thus assess the objective possibility
of using the radar to prevent a dangerous approach of airships? We will assume that
the BRLS antenna, which forms an acicular radiation pattern, oscillates in a hori-
zontal plane. The antenna's radiation pattern has a certain amount of width in the
vertical plane, however, and so the BRLS performs a radar scan of the air space in
elevation in a certain sector. This is why it is of practical interest to determine
whether or not the radar detects only aircraft at the same altitude or whether or
not there are airships in the field of view which may be nearby at adjacent flight
levels.

In solving this problem, we must consider the aircraft to be a pinpoint radar target, i.e., a target with a size which can be ignored (in comparison with the distance to it). The basic radar equation for such targets in this instance (with consideration of the fact that in the BRLS one and the same antenna is used as transmitter and receiver) can be written in the following form: $R = R_0 F(\beta)$,   (1) where R is the range of target detection with a given probability; R_0 is the maximum detection range of this same target with the very same probability, when the target is in the direction of the peak of the antenna radiation pattern, i.e., in the direction OA (Fig. 1); and $F(\beta)$ is the function describing the normalized antenna radiation pattern by field intensity in the vertical plane.
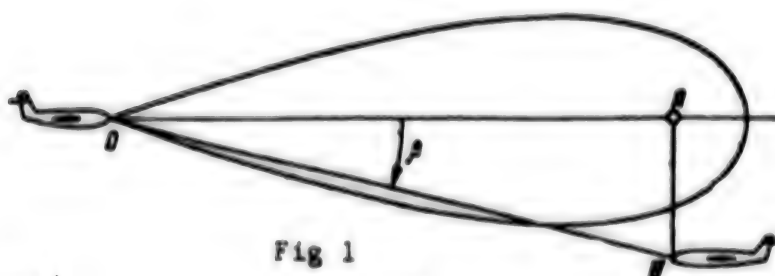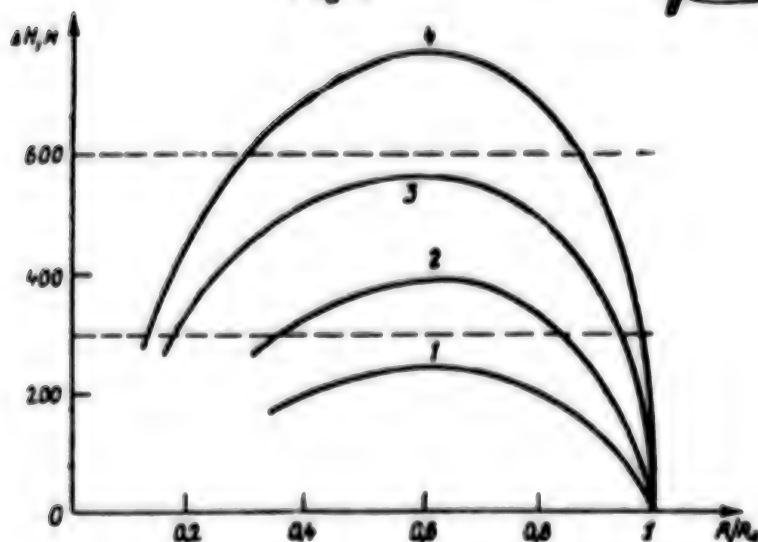

Fig 1

Fig 2

Ratio of ΔH to R/R_0 with different values of R_0 and β_0:
1 — $R_0 = 10$ km, $\beta_0 = 4^\circ$; 2 — $R_0 = 15$ km, $\beta_0 = 4^\circ$;
3 — $R_0 = 30$ km, $\beta_0 = 5^\circ$; 4 — $R_0 = 30$ km, $\beta_0 = 6^\circ$.

Here R_0 depends on the BRLS output characteristics as well as on the effective reflective surface of the target, which characterizes the targets' capability to reflect radio waves more or less intensively.

An acicular radiation pattern is approximated rather accurately analytically by a bell curve, i.e., $F(\beta) = e^{-0.35(2\beta/\beta_0)^2}$, where β is the angle between the direction of the antenna's radiation pattern peak and the direction to the aircraft to be detected; and β_0 is the width of the radiation pattern in power at the level of 0.5 from the peak.

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Then equation (I) can be written in the following form:

$$R = R_0 e^{-0.35\,(2\beta/\beta_0)^2}.\quad \text{(II)}$$

On the other hand, it follows from the triangle OAB (see Fig. 1):

$$\Delta H = R \sin \beta,\quad \text{(III)}$$

where ΔH is the difference in altitudes of the aircraft on which the BRLS is located and which in Fig. 1 is located at point O, and the aircraft being detected, located at point B.

Determining angle β from expression (II) and substituting its value into equation (III), we will obtain:

$$\Delta H = R \sin \sqrt{\frac{\beta_0}{1.4} \ln \frac{R_0}{R}}.$$

The latter expression makes it possible to determine the difference in flight altitudes of two aircraft ΔH, at which one of the aircraft is detected with the help of the airborne radar of the other aircraft (with a given distance between them of R). The values R_0 and β_0 in this expression are parameters for the BRLS of modern passenger aircraft and their values are within the ranges $R_0 = 10 \div 30$ км, $\beta_0 = 3 \div 4.2°$ (with other conditions being equal, the lesser value R_0 corresponds to the greater value β_0). The dependence of ΔH on relative detection range R_0/R with the indicated maximum and minimum values of β_0 and R_0 and the invariable probability of detection of one aircraft with the help of the BRLS of another is shown in Fig. 2. The conclusion can be drawn from this that an aircraft located at an adjacent flight level may be detected with BRLS at a considerable distance, which in some cases differs little from the range of detection of an aircraft located at the same altitude as the aircraft with the BRLS (in Fig. 2 the values ΔH corresponding to the difference of flight levels in altitude are denoted by dotted lines).

It is this condition which considerably limits the effectiveness of using the BRLS to prevent the dangerous approach of airships. In addition, the possibility of using the BRLS for these purposes is practically precluded at low flight altitudes, when rather bright clutter is observed on the screen from the surface of the ground and which conceals the blips of aircraft.

The BRLS thus can be used to prevent a dangerous approach of airships only as an auxiliary means, since in itself it does not ensure satisfactory accomplishment of this task. In addition, it should be remembered in using the BRLS for this purpose that even when the antenna scans in a horizontal plane, the radar can detect aircraft at an altitude differing hundreds of meters from that of the aircraft with the BRLS.

THE CORRELATION FUNCTION OF A WIDEBAND SIGNAL TAKING INTO ACCOUNT THE AMPLITUDE DISTRIBUTION IN THE APERTURE OF A PHASED ANTENNA ARRAY

MAKSAKOV, N. F. and SOKURENKO, V. L.

[Abstract] An extended phased array is defined as one in which the wave delay in the aperture exceeds a value which is the inverse of the spectral width of the incoming signal, i. e. the size of the projection of the array aperture on the bearing line is greater than the spatial correlation interval of the signal. The influence of three kinds of amplitude distribution in the array aperture is analyzed for such extended arrays: uniform, cosinusoidal and triangular amplitude distributions. It is assumed that the radar observes a source radiating broadband spatially coherent signals; the radar system includes a linear equidistant space array, the main lobe of which coincides with the normal to the aperture, a device for calculating the correlation of the received and anticipated signals, and an envelope detector. The spacing between the receiving elements of the array is chosen so that the diffraction maxima of the directional pattern do not appear in the forward half-sphere of the antenna in the case of maximum beam deflection from the normal to the aperture. It is also assumed that the internal receive channels and components of the array are broadband elements while the radiating target is far enough from the receiving aperture that the incident waves form a plane front in the aperture. The properties of the normalized correlation function of a broadband signal depend substantially on the form of the amplitude distribution along the aperture and this dependence increases with an increase in the number of the spatial correlation intervals of the signal, imposed along the projection of the antenna aperture on the bearing line. In the cases treated here, the uniform amplitude distribution has the greatest relative impact on the level of the power losses in the system and the spatial-time resolution, while the sawtooth distribution has the least influence. Figures 4; references: 3 Russian.
[122-8225]

SYSTEMS ANALYSIS

INSTRUCTION IN METHODOLOGY OF THE SYSTEMS APPROACH AND ELEMENTS OF SYSTEM ANALYSIS

ZHERNENKO, A. S.

[Abstract] Definitions and a discussion are presented of the terms "systems approach," "system theory" and "system analysis." The steps in system design are detailed. Special emphasis is placed on the course entitled "Machine Design of Systems and Electric Power Supplies on the Basis of Their Structural and Parametric Optimization in a Multidimensional Space of Quality Indicators" developed at the Department of Communications Equipment Electric Power, Leningrad Electrical Engineering Institute of Communications imeni M. A. Bonch-Bruyevich. This course covers the following in part: 1) Stages in designing on the basis of the systems approach and the advantages of systems design; 2) Key tenets of system analysis; 3) Classification of raw data; 4) Structural and parametric optimization of systems; 5) The use of heuristic and mathematical methods in structural optimization; 5) Construction of a generalized structural diagram and the isolation from it of close to optimal variants; 7) The use of the categorical preference criterion for forming a set of effective variants of structures of the system being designed; 7) The resulting overall quality criterion and its derivation; 8) The problem of the parametric optimization of systems having a specific structure; and 9) The application of methods of linear programming for the parametric optimization of systems and stages in the design and the technological development of systems having an optimal structure and parameters. Also treated are automated design systems (SAPR's) and their application in designing electric power systems. This course has proven effective in instructing students in the methodology of the systems approach and elements of system analysis and in providing them with skills in designing algorithms for the structural and parametric optimization of systems and electric power supplies in a multidimensional space of quality indicators. References: 2 Russian. [116-8831]

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